Model Technical Specification Project: High-Efficiency 2′x2′ Troffers

The U.S. Department of Energy (DOE), its national laboratories, and Commercial Building Energy Alliance (CBEA) members are working to support the market introduction of high-performance 2′x2′ lighting troffers. A CBEA Project Team is focused on making reliable, energy-efficient, and competitively priced 2′x2′ troffers more widely available in the marketplace.

DOE's CBEA Project Teams are focusing on reducing commercial building energy costs and consumption by working with a host of industry suppliers, including appliance, heating, cooling, and lighting manufacturers, to meet members' energy-efficiency needs. One area in particular that offers immediate returns is lighting. To date, CBEA Project Teams have developed specifications for LED parking lot lighting, high-efficiency parking structure lighting, and LED refrigerated case display lighting (see www1.eere.energy.gov/buildings/alliances/technologies.html). A CBEA Project Team is currently focusing efforts on development of a specification for high-efficiency 2'x2' lighting troffers.

DOE and the CBEAs identified 2'x2' troffers as a prominent application in commercial buildings and acknowledged rapid improvements in solid-state lighting (SSL)—also known as LEDs, or light-emitting diodes, technology—as an opportunity for increased performance and energy efficiency. In November 2010, a CBEA Project Team was formed to develop technical specifications and establish performance levels for this product category. While LEDs have a strong potential to meet this specification, other technologies are not excluded because the specification will be technology neutral.

Photo Credit: Cree LED Lighting

Cree CR22™ recessed troffer using solid-state lighting technology.

DOE Support

DOE provides technical assistance in support of this specification project, including:

- Product performance testing
- Product demonstration technical support
- Analysis of energy cost savings
- Analysis/quantification of maintenance cost savings
- Investigations into life measurements and other performance indicators
- Development and maintenance of the CBEA product performance specification
- Technology specification technical assistance.

The specification was released in June 2011 and can be found at www1.eere.energy.gov/buildings/alliances/technologies.html.

CBEA Member Opportunities and Benefits

There are several ways to be involved in the 2'x2' Troffer Project Team: identifying candidate products, reviewing product laboratory testing, conducting field demonstrations, and evaluating candidate products. Interested CBEA members can benefit from this project in a variety of ways, from simply being better informed of the potential of high-efficiency 2'x2' troffers (from DOE research and reports from other members), to being among the first to hear about new and promising technologies, to participating in demonstration projects and purchasing products that meet the specification requirements.

Project Next Steps

- Demonstration projects hosted by CBEA members
- Possible large coordinated CBEA purchases are anticipated in fall 2011.

Energy Savings

If designed and installed properly, high-efficiency 2'x2' troffers can derive energy savings of 20 to 25 percent on a one-to-one basis compared to traditional fluorescent troffers, and up to 50 percent if integrated with dimming, occupant, or daylight controls. In addition to the direct energy cost savings, maintenance costs are reduced because of the need for fewer and less frequent lamp replacements. For the benefits of high-efficiency 2'x2' troffers, see Table 1.

Table 1. Benefits of High-Efficiency Troffers, as Defined in the CBEA Specification

Product Feature	LED	Fluorescent
Efficacy	Less wattage is required to produce equivalent light levels.	
Controls	Inherently dimmable but compatibility should be verified prior to commitment.	Dimmable when mated with a dimming ballast and associated controls.
Environmental Impact	Contains no mercury.	Contains a very limited amount of mercury (less than the amount allowed in fish). Some lead in glass.
Longer Life/Lumen Maintenance	Expected long life of 50,000+ hours, but actual end-of-life performance is not completely understood.	Expected life of 24,000 to 46,000 hours. Actual value depends on ballast plus lamp pairing and controls.

Technical Specification

CBEA Project Team members have developed a technical specification for 2'x2' troffers. Key performance parameters of the specification can be found in Table 2. See www1.eere.energy.gov/buildings/alliances/technologies.html for the specification.

Table 2. Performance Parameters of the CBEA Technical Specification for 2′x2′ Troffers

Performance Attribute	Specification	Notes
Initial Luminaire Light Output	≥ 3,700 lumens	
Luminaire Efficacy	≥ 69 lm/W	Measured according to IESNA LM-79-2008
Input Power	≤ 54 W	54 W represents a 20% reduction in energy use from the "average" 2′x2′ fluorescent troffer.
Minimum Lumen Maintenance/ Lamp Life	**For SSL-based Luminaires** L_{70} ≥ 36,000 hours **For Fluorescent-based Luminaires** Rated Lamp Life ≥ 35,000 hours	**For SSL-based Luminaires** Based upon LM-80 data and In-situ Temperature Measurement Test (ISTMT), evaluated @ 6000 hours with minimum lumen maintenance of 94.1%. The requirement may also be met by LM-80 data intersection of the exponential decay function $L_{70} = L_{100}e^{-\lambda t}$, where L = Luminance; λ is a constant; t = time = 35,000 hours.
Spacing Criteria (SC)	1.1 to 1.4 (in either the 0˚–180˚ or 90˚–270˚ planes)	Spacing Criteria is the ratio of fixture spacing to mounting height and establishes the point at which uniform illumination occurs between fixtures at a given mounting height.
Correlated Color Temperature (CCT)	Nominal CCTs and tolerances as defined by: **For SSL-based Luminaires** ANSI_NEMA_ANSLG C78.377-2008 "Specifications for the Chromaticity of Solid State Lighting Products" **For Fluorescent–based Luminaires** ANSI_NEMA_ANSLG C78.376-2001 "Specifications for the Chromaticity of Fluorescent Lamps" Nominal CCT **SSL-based**: 2700K, 3000K, 3500K, 4000K, 4500K, 5000K, 5700K, 6500K **Fluorescent-based**: 2700K, 3000K, 3500K, 4000K, 5000K, 6500K	Chromaticity tolerances defined by ANSI C78.376 and C78.377 correspond to 7-step MacAdam ellipses (approximated in the case of C78.377). In addition to the nominal CCTs defined for fluorescent sources, SSL products add 4500K and 5700K nominal CCTs.
Minimum Color Rendering Index (CRI)	R_a ≥ 80 and R_9 > 0	Equivalent to "800" series fluorescent lamps.
Warranty	3 years	

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Commercial Building Initiative

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